PATENT ABSTRACTS OF JAPAN

(11)Publication number : **11-185628**

(43)Date of publication of application : **09.07.1999**

(51)Int.Cl. H01J 11/02
H01J 17/20

(21)Application number : **10-273560**

(22)Date of filing : **28.09.1998**

(71)Applicant : **SAMSUNG DISPLAY DEVICES CO LTD**

(72)Inventor : **PARK DEUK-IL**
NAN CHUYU

(30)Priority

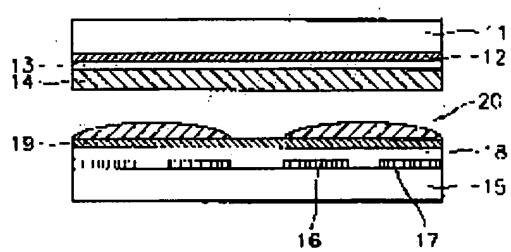
Priority number : **97 9766334** Priority date : **05.12.1997** Priority country : **KR**

(54) HELIUM DISCHARGE DISPLAY

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a helium discharge display without providing a filter for cutting off near infrared discharge to avoid a light loss caused by the filter that reduces a manufacturing cost.

SOLUTION: This is a plasma display provided with an upper substrate 11 on which an address electrode 12 is formed, dielectric 13 and phosphor 14 coated on a bottom surface of the upper substrate 11, a bottom substrate 15 on which a scanning electrode 16 and a common electrode 17 are formed, a discharge gas that is sealed between the upper substrate 11 and the lower substrate 15 including pure He, or mix of He of 99.5 vol or more, and at least one gas selected among remaining composition of Ne, Ar, Kr, Xe, and N2.



LEGAL STATUS

[Date of request for examination]	07.07.2004
[Date of sending the examiner's decision of rejection]	
[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]	
[Date of final disposal for application]	
[Patent number]	
[Date of registration]	
[Number of appeal against examiner's decision of rejection]	
[Date of requesting appeal against examiner's decision of rejection]	
[Date of extinction of right]	

CLAIMS

[Claim(s)]
[Claim 1] While being sealed between the up substrate with which the address electrode was formed, the dielectric and fluorescent substance which were applied to the underside of said up substrate, the lower substrate with which the scan electrode and the common electrode were formed, and said up substrate and a lower substrate The plasma display characterized by including the discharge gas with which at least one gas chosen from Ne, Ar, Kr, Xe, and N2 of a residual presentation was mixed with pure helium or helium of 99.5 or more vols.
[Claim 2] The plasma display according to claim 1 characterized by the pressure of said discharge gas being 100 - 760Torr.

[Translation done.]

* NOTICES *

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1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to a plasma display and relates to the plasma display which uses the mixed gas of helium (helium) and inert gas (rare gas) as discharge gas in more detail.
[0002]
[Description of the Prior Art] A plasma display is equipment which displays an image using a discharge-in-gases phenomenon, and the brightness and contrast of an image are good and, moreover, can secure a large angle of visibility. By impressing a direct current or an alternating current to an electrode, and making gas discharge, said plasma display forms an image, when ultraviolet rays are made to emit and said ultraviolet rays make a fluorescent substance emit light.
[0003] As gas mainly used for said plasma discharge gas, there is mixed gas of a neon (Ne)-xenon (Xe) or mixed gas of a (Helium helium)-xenon (Xe), and the content of said Xe is about one to 5 vol% here.
[0004] When using said mixed gas, since the reaction of Xe is superior, the vacuum ultraviolet radiation which had the wavelength of about about 147 - 200nm from this is emitted at the time of impression of an electrical potential difference. Therefore, said conventional plasma display is equipped with the fluorescent substance which can be excited by ultraviolet rays with the wavelength of 147 to 200 nm.
[0005] However, although the powerful near infrared ray which had not only ultraviolet rays but the wavelength of about 800 to 1,000 nm from said Xe is emitted when using discharge gas, such as said Ne-Xe or helium-Xe, this near infrared ray has a possibility of making other peripheral devices which operate with remote control malfunctioning. Therefore, a plasma display must possess the filter for intercepting said near infrared ray. This filter leading to lifting of the manufacturing cost of a plasma display, and reducing the brightness of a screen at least 30% or more is known. Furthermore, when using said Ne-Xe discharge gas, the light with yellow or red stronger than Ne gas is emitted, and there is a problem that the color purity of a display falls.
[0006] Furthermore, the discharge property of said Ne-Xe or helium-Xe mixed gas becomes instability dramatically as gas pressure increases.
[0007]
[Problem(s) to be Solved by the Invention] This invention is accomplished in order to solve the trouble by the activity of the mixed gas of said Ne-Xe or helium-Xe, its discharge property is stable, there is little bleedoff of the lights, such as yellow or red, and it sets it as the object to offer the discharge display which uses the mixed gas of helium-inert gas without bleedoff of a near infrared ray with the wavelength of further 800-1,000nm as discharge gas.
[0008]
[Means for Solving the Problem] The helium discharge display concerning this invention for attaining said object While being sealed between the up substrate with which the address electrode was formed, the dielectric and fluorescent substance which were applied to the underside of said up substrate, the lower substrate with which the scan electrode and the common electrode were formed, and said up substrate and a lower substrate The discharge gas with which at least one gas chosen from Ne, Ar, Kr,

Xe, and N2 of a residual presentation was mixed with pure helium or helium of 99.5 or more vols is included.
[0009] Furthermore, it is desirable that the pressure of said discharge gas is 100 - 760Torr.
[0010]
[Embodiment of the Invention] As discharge gas of the helium discharge display concerning this invention, the gas by which any one gas was mixed with pure helium or 99.5vol(s)% [which is moreover excellent in the discharge property] helium gase gas at least among Ne, Ar, Kr, Xe, and N2 is used, without emitting the near infrared ray of 800-1,000nm wavelength.
[0011] Here, although said inert gas and the presentation of N2 are restricted to less than [abbreviation 0.5vol%], this is for suppressing bleedoff of the light and a near infrared ray while guiding efficiently bleedoff of the ultraviolet rays by transition of helium element.
[0012] Drawing 1 is a drawing in which the structure of the helium discharge display by the gestalt of suitable operation of this invention is shown. If a drawing is referred to, the address electrode 12 will be formed in the underside of the up substrate 11, and sequential spreading of a dielectric 13 and the fluorescent substance 14 will be carried out on this underside. Moreover, on the lower substrate 15, the scan electrode 16 and the common electrode 17 are formed, and a dielectric 18 and the MgO protective coat 19 are applied on it.
[0013] Cross coupling of said up substrate 11 and lower substrate 15 is carried out sealing discharge gas in the meantime. Here, said discharge gas is mixed gas which serves as pure helium or 99.5% or more of helium gase gas from any one gas at least among Ne, Ar, Kr, Xe, and N2 as mentioned above. If the presentation of Ne, Ar, Kr, Xe, and N2 in said discharge gas exceeds 0.5vol(s)%, while brightness will fall, since discharge voltage goes up, it is not desirable.
[0014] Furthermore, the existing fluorescent substance generally known can be used as said fluorescent substance 14.
[0015] actuation of a plasma display with the above structures -- setting -- said address electrode 12 -- about 190 -- after impressing the pulse voltage of V -- said scan electrode and common electrode 17 -- about 180 -- if the alternating voltage of V is impressed, the pure helium gas in the discharge space 20 between the scan electrode 16 and the common electrode 17 or helium-mixing discharge gas will be in the plasma state. Since the presentation of said Ne, Ar, Kr, Xe, and N2 gas is restricted to 0.5vol(s)%, while discharge of helium becomes dominance and ultraviolet rays are emitted from this at this time, a fluorescent substance 14 will emit light with the emitted vacuum ultraviolet radiation.
[0016] On the other hand, since the near infrared ray of 800-1,000nm field is hardly emitted from said helium, it is not necessary to provide the special filter for intercepting this. In addition, the pressure of said discharge gas is preferably made into 760 torrs equal to atmospheric pressure more than about 100 torr (torr). If it becomes the pressure of 100 torrs or less, luminous efficiency will be low and breakdown voltage will go up. On the other hand, there is a possibility that a discharge panel may be transformed, by the pressure of 760 torrs or more.
[0017] The effectiveness of this this invention becomes still clearer through the example of an experiment mentioned later below.
[0018] The discharge gas used in the example of a <example of experiment> book experiment for measurement of the light of discharge gas and a near infrared ray spectrum is pure helium gas, helium-Ne (10vol%), helium-Ar (0.1vol%), helium-Ar (0.01vol%), and helium-Ne(30vol%)-Xe (5vol%) mixed gas. In this example of an experiment, the panel used for measurement of a spectrum was field discharge mold structure, and in order to measure the bleedoff luminous intensity in an ultraviolet-rays field with a sufficient precision, the quartz plate was used as a measuring plane of a test panel. Under the present circumstances, the pressure of said discharge gas is 350 torrs, driver voltage is 230V, and drive frequency is 50kHz.
[0019] The spectrum of helium-Ne (10vol%) mixed gas and drawing 4 show the spectrum of helium-Ar (0.01vol%) and helium-Ne(30vol%)-Xe (5vol%) by the spectrum of helium-Ar (0.1vol%) mixed gas, and the spectrum of pure helium gas and drawing 3 show drawing 5 for drawing 2 with relative intensity, respectively.

[0020] As shown in drawing 2 , the spectrum in a pure helium discharge in gases is strong in a 300-400nm ultraviolet-rays field, and its luminous intensity is very weak in the light and an infrared field.
[0021] In the graph of drawing 3 , the ultraviolet-rays reinforcement of helium shows that the light by Ne, i.e., yellow luminous intensity, is size. Therefore, if the amount of Ne becomes about 0.5vol% in helium-Ne mixed gas, since yellow luminous intensity will become very strong, as for the amount of Ne, reducing as much as possible is desirable.
[0022] If drawing 4 which shows the spectrum of helium-Ar (0.1vol%) discharge gas is referred to, it turns out that it is similar to the case where the modality of the spectrum is said pure helium. However, if Ar gas is added by helium 0.1%, it turns out that ultraviolet-rays reinforcement and the reinforcement of the light become large.
[0023] In drawing 5 , a continuous line shows the spectrum of helium-Ar (0.01vol%), and a dotted line shows the spectrum of helium-Ne(30vol%)-Xe (5vol%), respectively. As shown in a drawing, by the spectrum of helium-Ar (0.01vol%) discharge gas, the ultraviolet rays of 389nm wavelength of abbreviation and the light of 706nm wavelength of abbreviation appeared strongly. Radiation of such ultraviolet rays and the light is based on transition of helium atom.
[0024] On the other hand, the spectrum of helium-Ne(30vol%)-Xe (5vol%) discharge gas appeared strongly on the visible region wavelength of 590nm and 640nm, and the near infrared ray field wavelength of 830nm and about 900nm. The light of said 590nm and 640nm wavelength is produced by transition of Ne atom, and luminescence of 640nm red light becomes strong as Ne content increases. Moreover, the near infrared ray of 830nm and 900nm field is based on transition of Xe atom.
[0025] Conclusively, compared with the helium-Ne(30vol%)-Xe (5vol%) discharge gas used conventionally, it turns out that the light of helium-Ar (0.01vol%) discharge gas and the intensity of radiation of a near infrared ray are very weak.
[0026] Drawing 6 is the example of an experiment of further others of this invention, and shows the brightness which follows the pressure variation of helium-Ar (0.01vol%) discharge gas under a fixed electrical potential difference. As a result shows, it turns out that brightness increased with the pressure of discharge gas and discharge is stable also by the high voltage force 500 torrs or more. However, if the pressure of discharge gas is 760 torrs or more, and there will be a possibility that a discharge panel may be transformed and it will become the pressure of 100 torrs or less, luminous efficiency will be low and breakdown voltage will go up.
[0027] Drawing 7 measures the brightness by the electrical potential difference of the helium-Ne (30vol%)-Xe (5vol%) discharge gas (a continuous line illustrates) of a 350-torr pressure, and the helium-Ar (0.01vol%) discharge gas (a dotted line illustrates) of a 650-torr pressure. As a result of the experiment, the brightness of helium-Ne(30vol%)-Xe (5vol%) discharge gas was 122 cd/m2 in 220V, and the brightness of helium-Ar (0.01vol%) discharge gas was 123 cd/m2 in 220V. It turns out that the brightness of said discharge gas decreases-like proportionally as an electrical potential difference decreases. Although discharge became instability and partial luminescence started when the electrical potential difference was too low, in the case of helium-Ne(30vol%)-Xe (5vol%) discharge gas, this partial luminescence is less than [210V], and, in the case of helium-Ar (0.01vol%) discharge gas, was started less than [190V].
[0028] The brightness of the helium-Ar (0.01vol%) discharge gas of this invention is almost equal to the brightness of conventional helium-Ne(30vol%)-Xe (5vol%) discharge gas so that drawing 7 may show.
[0029] Moreover, in the example of an experiment which is not illustrated, the brightness to pure helium, helium-Ar, helium-Ne-Ar, and helium-Ne-Ar-Xe discharge gas was measured. The brightness of helium-Ar (0.01vol%) and helium-Ar (0.005vol%) is the highest as a result of an experiment.

TECHNICAL FIELD

[Field of the Invention] This invention relates to a plasma display and relates to the plasma display which uses the mixed gas of helium (helium) and inert gas (rare gas) as discharge gas in more detail.

[Translation done.]

PRIOR ART

[Description of the Prior Art] A plasma display is equipment which displays an image using a discharge-in-gases phenomenon, and the brightness and contrast of an image are good and, moreover, can secure a large angle of visibility. By impressing a direct current or an alternating current to an electrode, and making gas discharge, said plasma display forms an image, when ultraviolet rays are made to emit and said ultraviolet rays make a fluorescent substance emit light.
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[0004] When using said mixed gas, since the reaction of Xe is superior, the vacuum ultraviolet radiation which had the wavelength of about about 147 - 200nm from this is emitted at the time of impression of an electrical potential difference. Therefore, said conventional plasma display is equipped with the fluorescent substance which can be excited by ultraviolet rays with the wavelength of 147 to 200 nm.
[0005] However, although the powerful near infrared ray which had not only ultraviolet rays but the wavelength of about 800 to 1,000 nm from said Xe is emitted when using discharge gas, such as said Ne-Xe or helium-Xe, this near infrared ray has a possibility of making other peripheral devices which operate with remote control malfunctioning. Therefore, a plasma display must possess the filter for intercepting said near infrared ray. This filter leading to lifting of the manufacturing cost of a plasma display, and reducing the brightness of a screen at least 30% or more is known. Furthermore, when using said Ne-Xe discharge gas, the light with yellow or red stronger than Ne gas is emitted, and there is a problem that the color purity of a display falls.
[0006] Furthermore, the discharge property of said Ne-Xe or helium-Xe mixed gas becomes instability dramatically as gas pressure increases.

[Translation done.]

EFFECT OF THE INVENTION

[Effect of the Invention] Since the helium discharge display by this invention does not almost have bleedoff of a near infrared ray, it does not need to possess the filter for intercepting this separately, and a manufacturing cost is not only reducible by this, but it does not have optical loss with a filter.

[Translation done.]

* NOTICES *

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] This invention is accomplished in order to solve the trouble by the activity of the mixed gas of said Ne-Xe or helium-Xe, its discharge property is stable, there is little bleedoff of the lights, such as yellow or red, and it sets it as the object to offer the discharge display which uses the mixed gas of helium-inert gas without bleedoff of a near infrared ray with the wavelength of further 800-1,000nm as discharge gas.

[Translation done.]

MEANS

[Means for Solving the Problem] The helium discharge display concerning this invention for attaining said object While being sealed between the up substrate with which the address electrode was formed, the dielectric and fluorescent substance which were applied to the underside of said up substrate, the lower substrate with which the scan electrode and the common electrode were formed, and said up substrate and a lower substrate The discharge gas with which at least one gas chosen from Ne, Ar, Kr, Xe, and N2 of a residual presentation was mixed with pure helium or helium of 99.5 or more vols is included.
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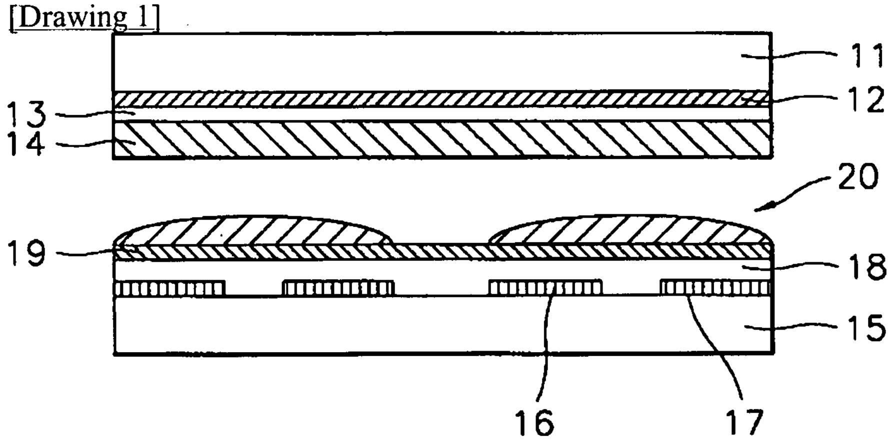
DESCRIPTION OF DRAWINGS

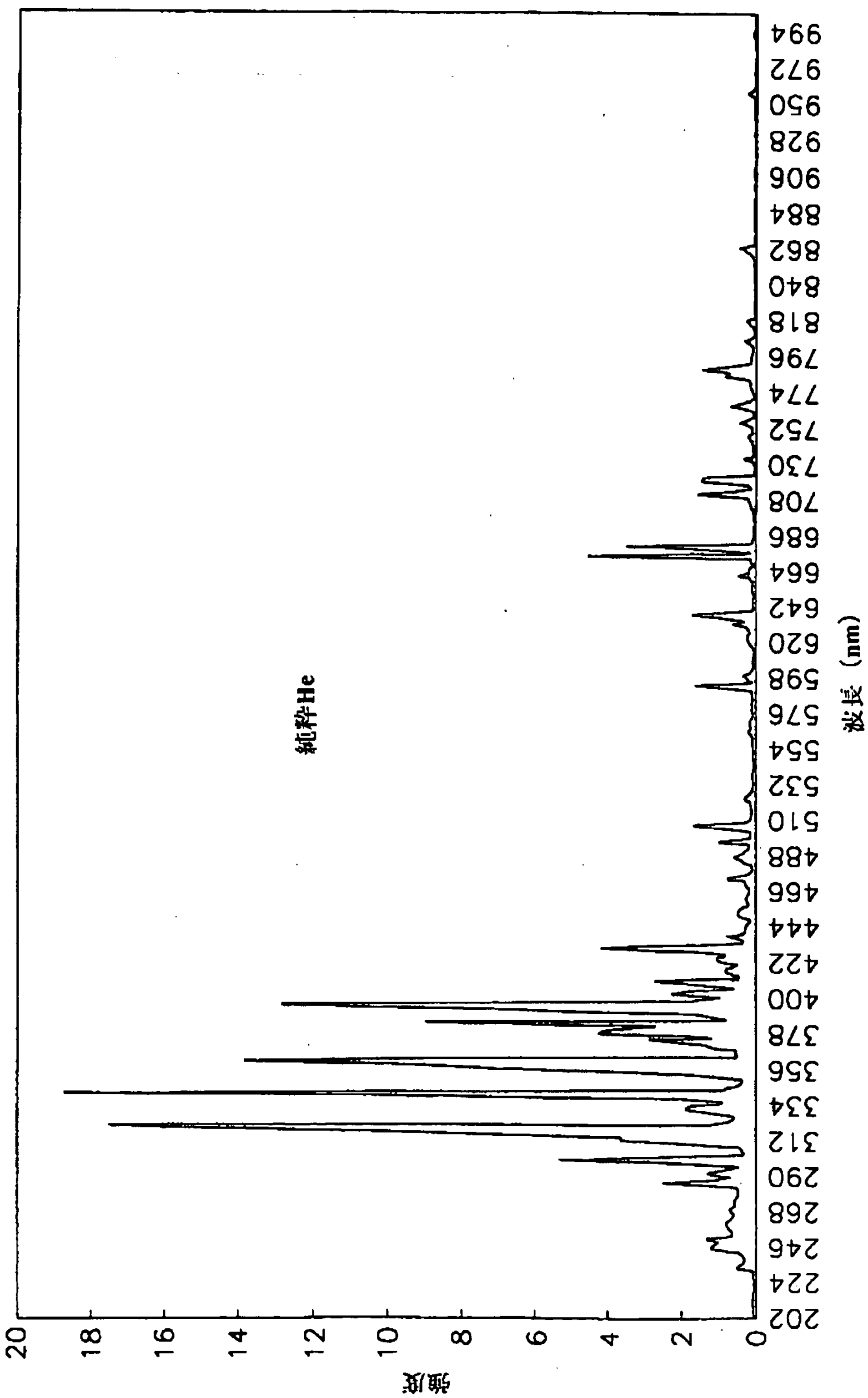
[Brief Description of the Drawings]
[Drawing 1] The sectional view showing the helium discharge display by this invention.
[Drawing 2] The graph which shows the discharge spectrum of the display which adopted the pure helium discharge gas by this invention.
[Drawing 3] The graph which shows the discharge spectrum of the display which adopted the helium-Ne (10vol%) discharge gas by this invention.
[Drawing 4] The graph which shows the discharge spectrum of the display which adopted the helium-Ar (0.1vol%) discharge gas by this invention.
[Drawing 5] The graph which shows the discharge spectrum of the display which adopted the helium-Ar (0.01vol%) discharge gas by this invention, and the display which adopted conventional helium-Ne (30vol%)-Xe (5vol%) discharge gas, respectively.
[Drawing 6] The graph which shows the brightness change accompanying the discharge pressure of the display which adopted the helium-Ar (0.01vol%) discharge gas by this invention.
[Drawing 7]

DRAWINGS

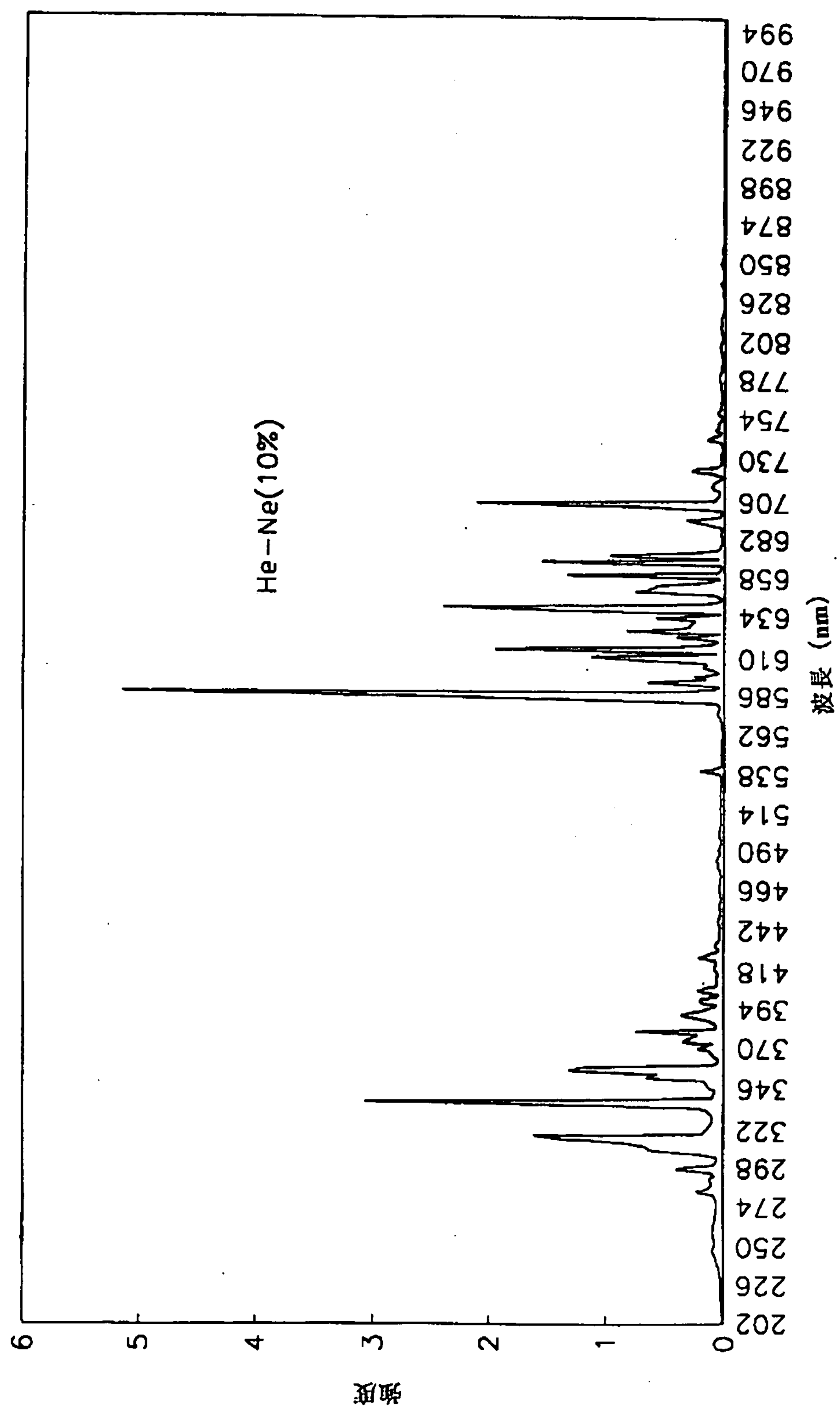
[Drawing 1]



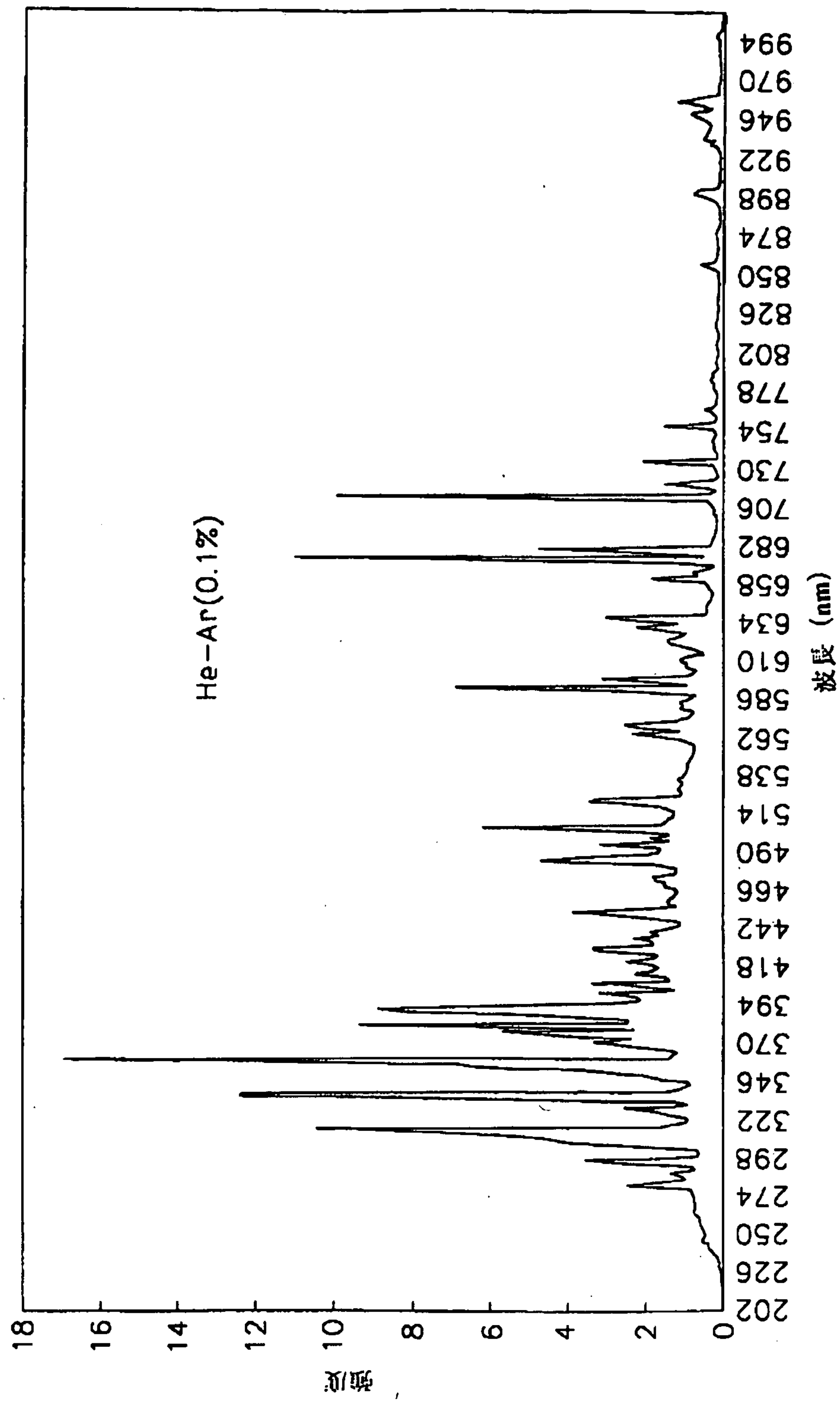
[Drawing 2]



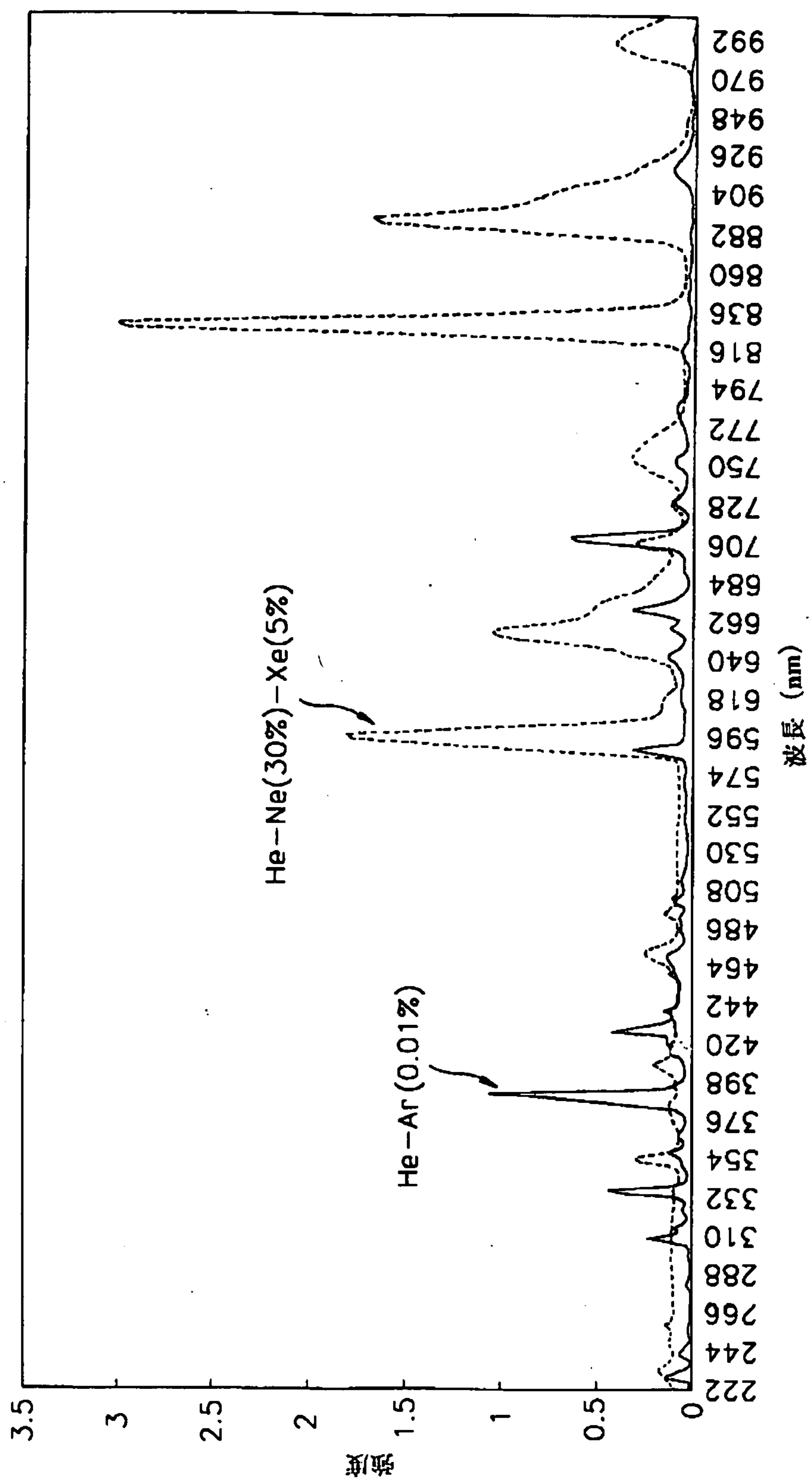
[Drawing 3]



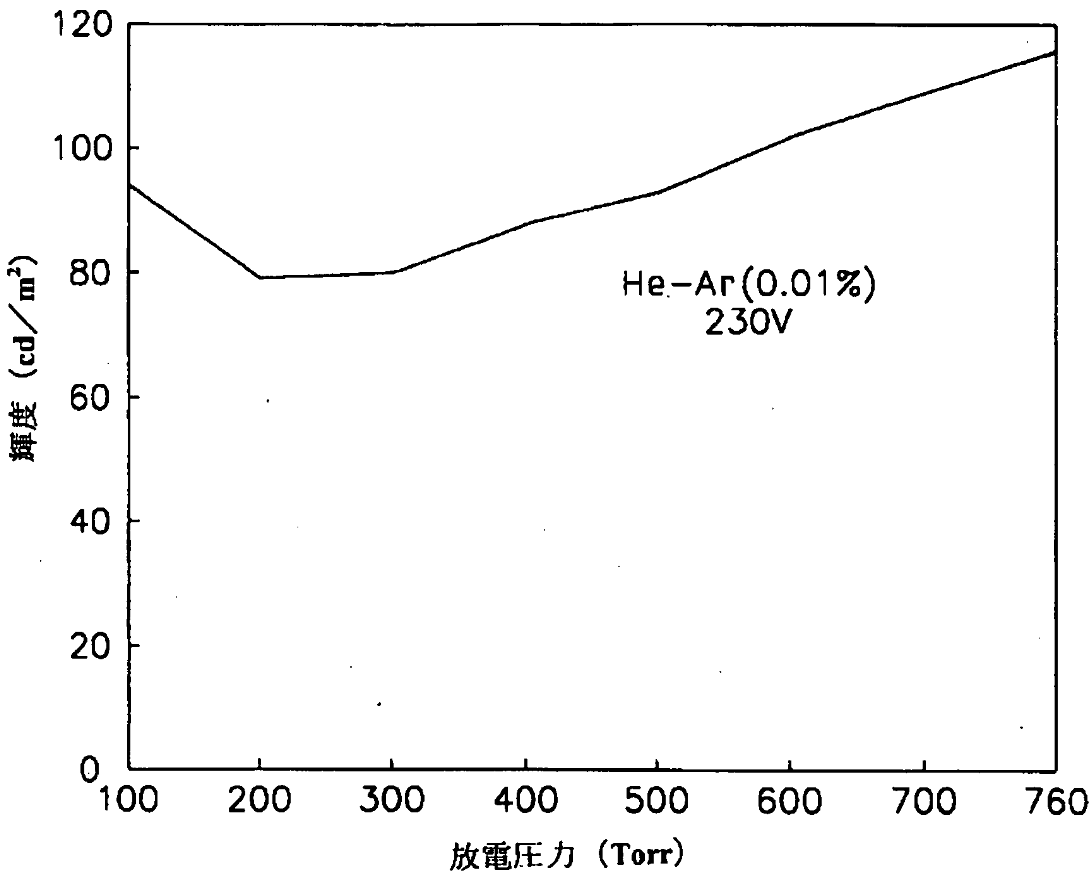
[Drawing 4]


He-Ar(0.1%)
波長 (nm)
強度
202 226 250 274 298 322 346 370 394 418 442 466 490 514 538 562 586 610 634 658 682 706 730 754 778 802 826 850 874 898 922 946 970 994
0 2 4 6 8 10 12 14 16 18

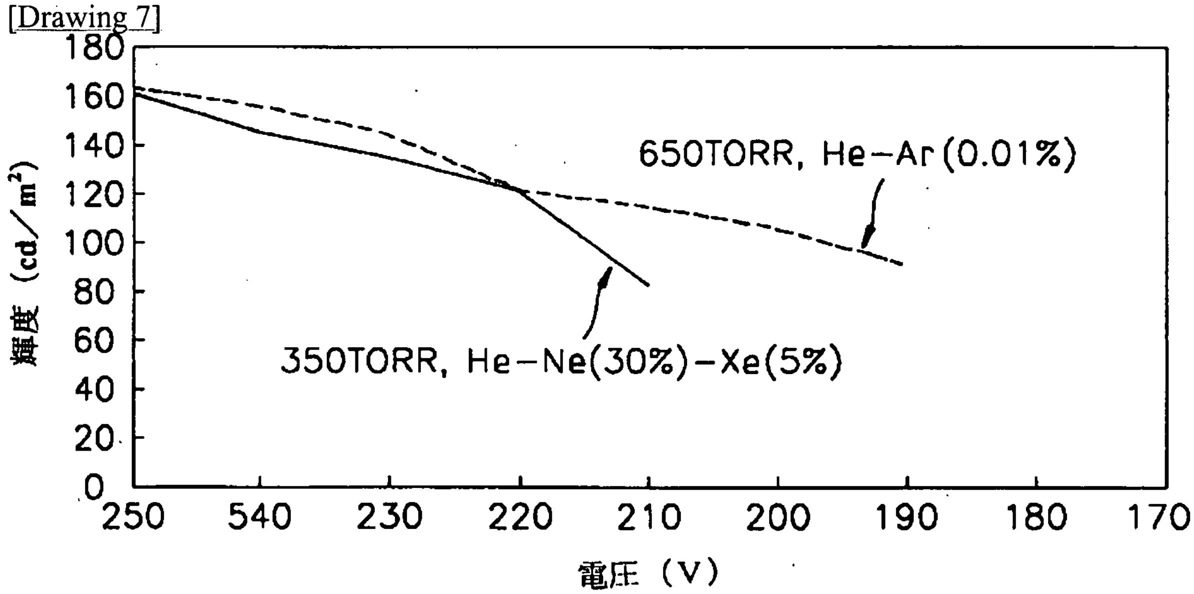
[Drawing 5]



[Drawing 6]



[Drawing 7]



[Translation done.]

(19)日本国特許庁（ＪＰ）　(12)公開特許公報（Ａ）　(11)特許出願公開番号

特開平11－185628

(43)公開日　平成11年(1999)7月9日

(51)Int.Cl.⁶　識別記号　ＦＩ

ＨＯ１Ｊ 11/02　ＨＯ１Ｊ 11/02　Ａ

17/20　17/20

審査請求　未請求　請求項の数２　ＯＬ（全９頁）

(21)出願番号　特願平10－273560

(22)出願日　平成10年(1998)９月28日

(31)優先権主張番号　１９９７－６６３３４

(32)優先日　1997年12月５日

(33)優先権主張国　韓国（ＫＲ）

(71)出願人　590002817
三星電管株式會社
大韓民國京畿道水原市八達區▲しん▼洞
575番地

(72)発明者　朴　得一
大韓民國京畿道水原市八達區▲しん▼洞
575番地　三星電管株式會社内

(72)発明者　南　仲祐
大韓民國京畿道水原市八達區▲しん▼洞
575番地　三星電管株式會社内

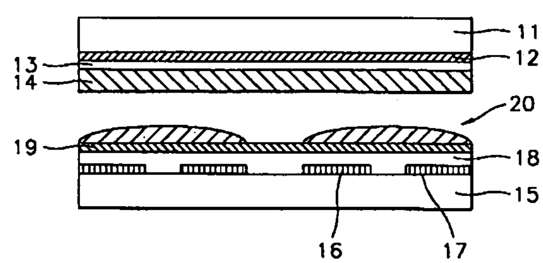
(74)代理人　弁理士　和田　成則

(54)【発明の名称】　ヘリウム放電ディスプレー

(57)【要約】

【課題】　近赤外線の放出を遮断するためのフィルターを具備する必要がなく、製造コストが節減でき、フィルターによる光損失がないヘリウム放電ディスプレーを提供する。

【解決手段】　アドレス電極12が形成された上部基板11と、前記上部基板11の下面に塗布された誘電体13及び蛍光体14と、走査電極16及び共通電極17が形成された下部基板15と、前記上部基板11及び下部基板15の間に密封されるとともに、純粋He、または99.5vol以上のHeと残余組成のNe、Ar、Kr、Xe及びN_2から選ばれた少なくとも一つのガスが混合された放電ガスとを含むことを特徴とするプラズマディスプレー。



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【特許請求の範囲】

【請求項１】　アドレス電極が形成された上部基板と、
前記上部基板の下面に塗布された誘電体及び蛍光体と、
走査電極及び共通電極が形成された下部基板と、
前記上部基板及び下部基板の間に密封されるとともに、純粋He、または99.5vol以上のHeと残余組成のNe、Ar、Kr、Xe及びN_2から選ばれた少なくとも一つのガスが混合された放電ガスとを含むことを特徴とするプラズマディスプレー。

【請求項２】　前記放電ガスの圧力が100～760Torrであることを特徴とする請求項１に記載のプラズマディスプレー。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、プラズマディスプレーに係り、更に詳しくは、ヘリウム（He）と不活性ガス（rare gas）との混合ガスを放電ガスとして使用するプラズマディスプレーに関する。

【０００２】

【従来の技術】プラズマディスプレーは、ガス放電現象を使用して画像を表示する装置であって、画像の輝度及びコントラストが良好で、しかも、広い視野角を確保できる。前記プラズマディスプレーは、直流または交流を電極に印加してガスを放電させることにより紫外線を放出させ、また、前記紫外線が蛍光体を発光させることにより画像を形成する。

【０００３】前記プラズマ放電ガスに主に使われるガスとしては、ネオン（Ne）－キセノン（Xe）の混合ガス、あるいはヘリウム（He）－キセノン（Xe)の混合ガスがあり、ここで、前記Xeの含量は約1－5vol%である。

【０００４】前記混合ガスを使用する場合、電圧の印加時にXeの反応が優勢であるから、これより約147－200nm程度の波長をもった真空紫外線が放出される。そのため、前記従来のプラズマディスプレーは147－200nmの波長をもった紫外線によって励起できる蛍光体を備えている。

【０００５】しかし、前記Ne－XeまたはHe－Xeなどの放電ガスを使用する場合、前記Xeから紫外線ばかりでなく約800－1,000nmの波長をもった強い近赤外線が放出されるが、この近赤外線はリモコンにより作動される他の周辺機器を誤動作させる恐れがある。そのため、プラズマディスプレーは前記近赤外線を遮断するためのフィルターを具備しなければならない。このフィルターはプラズマディスプレーの製造コストの上昇につながり、かつ、画面の輝度を少なくとも30%以上低下させることが知られている。さらに、前記Ne－Xe放電ガスを使用するとき、Neガスより黄色または赤色の強い可視光が放出され、ディスプレーの色純度が低下するといった問題がある。

【０００６】さらには、前記Ne－XeまたはHe－Xe混合ガスの放電特性はガス圧力が増加するにつれ非常に不安定になる。

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【０００７】

【発明が解決しようとする課題】本発明は、前記Ne－XeまたはHe－Xeの混合ガスの使用による問題点を解決するために成されたものであり、放電特性が安定で、黄色または赤色など可視光の放出が少なく、さらに800～1,000nmの波長をもつ近赤外線の放出がないHe－不活性ガスの混合ガスを放電ガスとして使用する放電ディスプレーを提供することをその目的とする。

【０００８】

【課題を解決するための手段】前記目的を達成するための本発明に係るヘリウム放電ディスプレーは、アドレス電極が形成された上部基板と、前記上部基板の下面に塗布された誘電体及び蛍光体と、走査電極及び共通電極が形成された下部基板と、前記上部基板及び下部基板の間に密封されるとともに、純粋He、または99.5vol以上のHeと残余組成のNe、Ar、Kr、Xe及びN_2から選ばれた少なくとも一つのガスが混合された放電ガスとを含む。

【０００９】さらに、前記放電ガスの圧力が100～760Torrであることが好ましい。

【００１０】

【発明の実施の形態】本発明に係るヘリウム放電ディスプレーの放電ガスとしては、800～1,000nm波長の近赤外線を放出することなく、しかも放電特性に優れている純粋Heまたは99.5vol%のHeベースガスとNe、Ar、Kr、Xe、N_2のうち少なくともいずれか一つのガスが混合されたガスが使用される。

【００１１】ここで、前記不活性ガス及びN_2の組成は約0.5vol%以下に制限されるが、これはHe元素の遷移による紫外線の放出を効率良く誘導するとともに、可視光及び近赤外線の放出を抑えるためである。

【００１２】図１は、本発明の好適な実施の形態によるヘリウム放電ディスプレーの構造を示す図面である。図面を参照すれば、上部基板11の下面にはアドレス電極12が形成され、この下面には誘電体13及び蛍光体14が順次塗布される。また、下部基板15上には走査電極16及び共通電極17が形成され、その上には誘電体18及びMgO保護膜19が塗布される。

【００１３】前記上部基板11と下部基板15とは、その間に放電ガスを密封したまま相互結合される。ここで、前記放電ガスは、前述のように純粋He、または99.5%以上のHeベースガスとNe、Ar、Kr、Xe、N_2のうち少なくとも何れか一つのガスとからなる混合ガスである。前記放電ガスにおけるNe、Ar、Kr、Xe、N_2の組成が0.5vol%を超過すれば、輝度が低下するとともに、放電電圧が上がるので好ましくない。

【００１４】更に、前記蛍光体14としては、一般に知られている既存の蛍光体が使用できる。

【００１５】前記のような構造をもつプラズマディスプ

レーの動作において、前記アドレス電極12に約190Vのパルス電圧を印加した後に、前記走査電極と共通電極17には約180Vの交流電圧を印加すれば、走査電極16と共通電極17との間の放電空間20にある純粋HeガスまたはHe－混合放電ガスがプラズマ状態となる。この時、前記Ne、Ar、Kr、Xe及びN_2ガスの組成は0．5vol%に制限されるのでHeの放電が優勢になり、これより紫外線が放出されるとともに、放出された真空紫外線によって蛍光体14が発光することになる。

【0016】一方、前記Heから800～1,000nm領域の近赤外線がほとんど放出されないので、これを遮断するための別途のフィルターを具備しなくても良い。加えて、前記放電ガスの圧力は約100トール（torr）以上、好ましくは、大気圧と等しい760トールにする。もし、100トール以下の圧力になってくると、発光効率が低く、放電開始電圧が上がる。反面、760トール以上の圧力では放電パネルが変形される恐れがある。

【0017】かかる本発明の効果は以下で後述される実験例を通して一層明確になる。

【0018】<実験例>本実験例で放電ガスの可視光と近赤外線スペクトルの測定のために使用された放電ガスは純粋Heガス、He－Ne(10vol%)、He－Ar(0.1vol%)、He－Ar(0.01vol%)及びHe－Ne（30vol%）－Xe（5vol%）混合ガスである。本実験例において、スペクトルの測定に使用されたパネルは面放電型構造であって、紫外線領域での放出光の強度を精度良く測定するためにテストパネルの測定面としては石英板が使用された。この際、前記放電ガスの圧力は350トールであり、駆動電圧は230Vで、駆動周波数は50kHzである。

【0019】図2は、純粋Heガスのスペクトル、図3はHe－Ne（10vol%）混合ガスのスペクトル、図4はHe－Ar（0.1vol%）混合ガスのスペクトル、図5はHe－Ar（0.01vol%）とHe－Ne(30vol%）－Xe（5vol%）のスペクトルをそれぞれ相対強度で示すものである。

【0020】図2に示すように、純粋Heガス放電におけるスペクトルは300～400nmの紫外線領域で強く、可視光と赤外線領域では光の強度が極めて弱い。

【0021】図3のグラフでは、Heの紫外線強度よりNeによる可視光、すなわち、黄色光の強度が大であることが分かる。従って、He－Ne混合ガスにおいてNeの量が0．5vol%程度になると、黄色光の強度が極めて強くなるので、Neの量はできる限り減らすことが好ましい。

【0022】He－Ar(0.1vol%)放電ガスのスペクトルを示す図4を参照すれば、そのスペクトルの様相が前記純粋Heの場合と類似であることが分かる。しかし、HeにArガスが0.1%添加されれば、紫外線強度と可視光の強度が大きくなることが分かる。

【0023】図5において、実線はHe－Ar（0.01vol%）のスペクトルを、点線はHe－Ne（30vol%）－Xe（5vol%）のスペクトルをそれぞれ示す。図面に示すように、He－Ar（0.01vol%）放電ガスのスペクトルでは略389nm波長の紫外線と略706nm波長の可視光が強く現れた。このような紫外線と可視光の放射はHe原子の遷移によるものである。

【0024】一方、He－Ne（30vol%）－Xe（5vol%）放電ガスのスペクトルは590nm、640nmの可視領域波長と830nm、900nm近傍の近赤外線領域波長で強く現れた。前記590nm、640nm波長の光はNe原子の遷移により生じるものであって、Ne含有量が増加するに従って640nmの赤色光の発光が強くなる。また、830nm、900nm領域の近赤外線はXe原子の遷移によるものである。

【0025】結論的に、He－Ar（0.01vol%）放電ガスの可視光及び近赤外線の放射強度は従来より使用されてきたHe－Ne（30vol%）－Xe（5vol%）放電ガスに比べ極めて弱いことが分かる。

【0026】図6は、本発明のさらに他の実験例であって、一定電圧下にHe－Ar（0.01vol%）放電ガスの圧力変化に従う輝度を示す。結果から分かるように、輝度は放電ガスの圧力によって増加し、500トール以上の高圧力でも放電が安定していることが分かる。しかし、放電ガスの圧力が760トール以上であれば、放電パネルが変形される恐れがあり、もし100トール以下の圧力になると、発光効率が低く、放電開始電圧が上がることになる。

【0027】図7は、350トール圧力のHe－Ne（30vol%）－Xe（5vol%）放電ガス（実線で図示）と650トール圧力のHe－Ar（0.01vol%）放電ガス（点線で図示）の電圧による輝度を測定したものである。実験の結果、He－Ne（30vol%）－Xe（5vol%）放電ガスの輝度は220Vで122cd/m²であり、He－Ar（0.01vol%）放電ガスの輝度は220Vで123cd/m²であった。前記放電ガスの輝度は電圧が減少するにつれて比例的に減少することが分かる。電圧が低すぎると、放電が不安定になり、部分発光がおこるが、この部分発光はHe－Ne（30vol%）－Xe（5vol%）放電ガスの場合210V以下で、そしてHe－Ar（0.01vol%）放電ガスの場合190V以下でおこった。

【0028】図7から分かるように、本発明のHe－Ar（0.01vol%）放電ガスの輝度は従来のHe－Ne（30vol%）－Xe（5vol%）放電ガスの輝度とほぼ等しい。

【0029】また図示していない実験例で、純粋He、He－Ar、He－Ne－Ar、He－Ne－Ar－Xe放電ガスに対する輝度が測定された。実験の結果、He－Ar（0.01vol%）、He－Ar（0.005vol%）の輝度が最高であって、次にHe－Ne（30vol%）－Xe（5vol%）、He－Ar（0.1vol%）、純粋He、He－Ne（0.1vol%）－Ar（0.1vol%）、He－Ne（0.1vol%）－Ar（0.1vol%）－Xe（0.1vol%）、He－Ne（0.5vol%）－Ar（0.5vol%）順に現われた。

【0030】また、混合ガスの混合比による輝度特性で、He－Ar（0.5vol%）放電ガスの輝度はHe－Ne（0.1vol%）－Ar（0.1vol%）－Xe（0.1vol%）の輝度とほぼ同一

で、He－Ar（0.01vol%）放電ガスの輝度に比べ略半分にすぎないことが分かった。

【００３１】反面、放電電圧はHe－Ne（0.1vol%）－Ar（0.1vol%）、He－Ne（0.1vol%）－Ar（0.1vol%）－Xe（0.1vol%）、He－Ar（0.1vol%）で最も低く、次にHe－Ne（0.5vol%）－Ar（0.5vol%）、He－Ar（0.01vol%）、He－Ar（0.005vol%）、純粋He、He－Ne（30vol%）－Xe（5vol%）順に現われた。この際、放電電圧が最低のHe－Ne（0.1vol%）－Ar（0.1vol%）と最高のHe－Ne（30vol%）－Xe（5vol%）間の放電維持電圧の差分は約50Vであった。

【００３２】本発明の実施の形態では面放電型プラズマディスプレーが開示されているが、これに限定されることなく、各種の形態の放電ディスプレーに適用することができる。

【００３３】

【発明の効果】本発明によるヘリウム放電ディスプレーは近赤外線の放出がほとんどないので、これを遮断するためのフィルターを別途具備する必要がなく、これにより製造コストを節減できるだけでなく、フィルターによる光損失がない。

【図面の簡単な説明】

【図１】本発明によるヘリウム放電ディスプレーを示す断面図。

【図２】本発明による純粋He放電ガスを採用したディスプレーの放電スペクトルを示すグラフ。

＊【図３】本発明によるHe－Ne（10vol%）放電ガスを採用したディスプレーの放電スペクトルを示すグラフ。

【図４】本発明によるHe－Ar（0.1vol%）放電ガスを採用したディスプレーの放電スペクトルを示すグラフ。

【図５】本発明によるHe－Ar（0.01vol%）放電ガスを採用したディスプレーと従来のHe－Ne（30vol%）－Xe（5vol%）放電ガスを採用したディスプレーの放電スペクトルをそれぞれ示すグラフ。

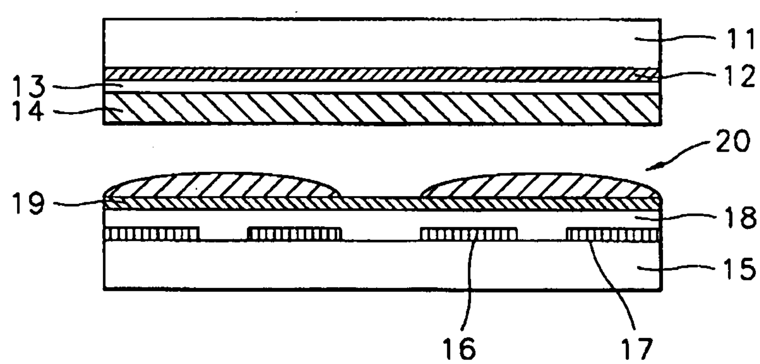
【図６】本発明によるHe－Ar（0.01vol%）放電ガスを採用したディスプレーの放電圧力に伴う輝度変化を示すグラフ。

【図７】従来の350トール圧力のHe－Ne（30vol%）－Xe（5vol%）放電ガスと本発明による650トール圧力のHe－Ar（0.01vol%）放電ガスをそれぞれ採用したディスプレーの電圧に伴う輝度変化を示すグラフ。

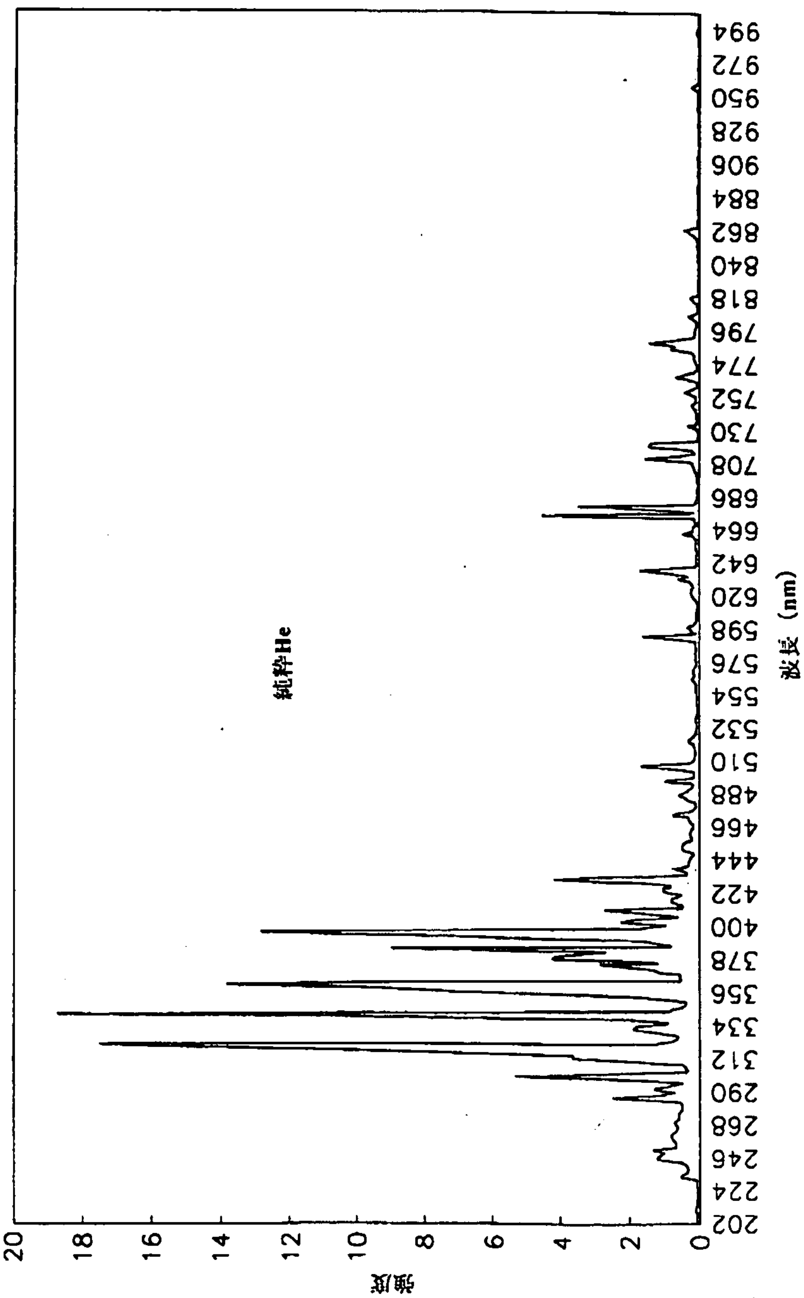
【符号の説明】

11 上部基板
12 アドレス電極
13 誘電体
14 蛍光体
15 下部基板
16 走査電極
17 共通電極
18 誘電体
19 保護膜
20 放電空間

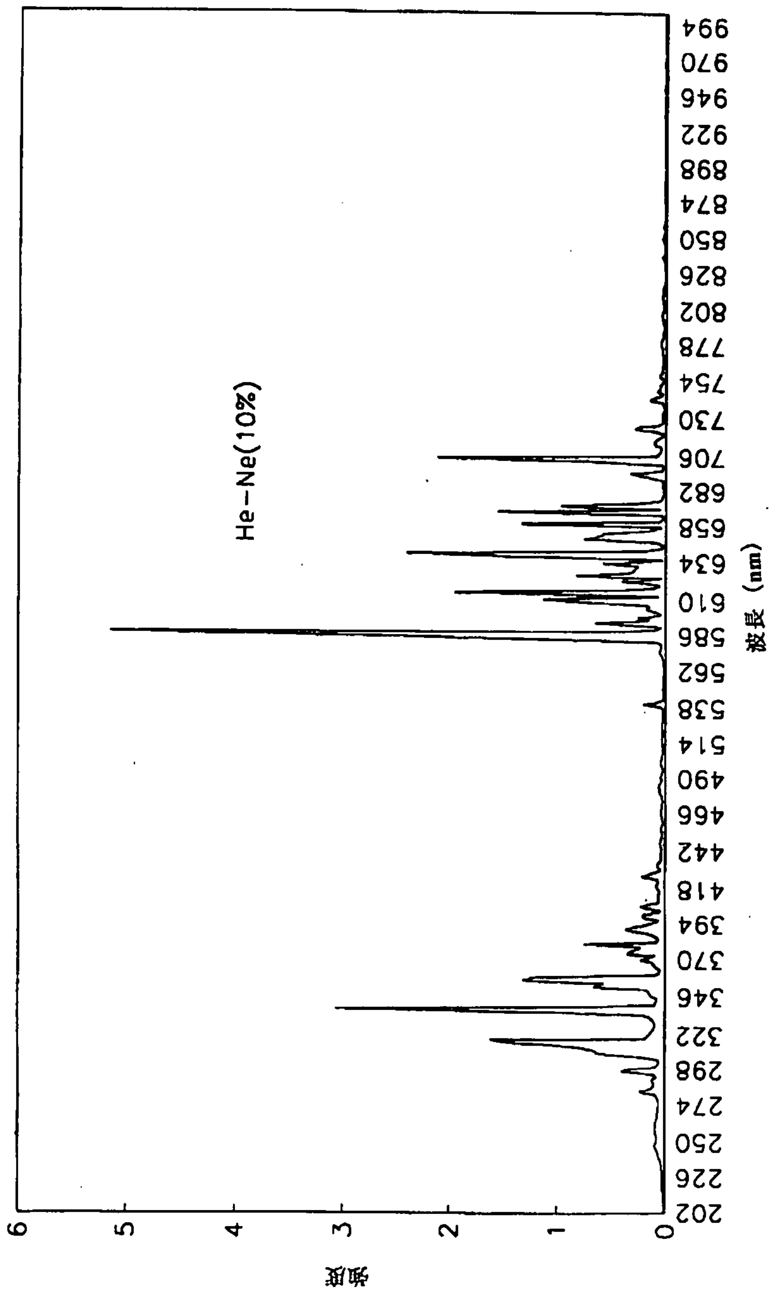
【図１】



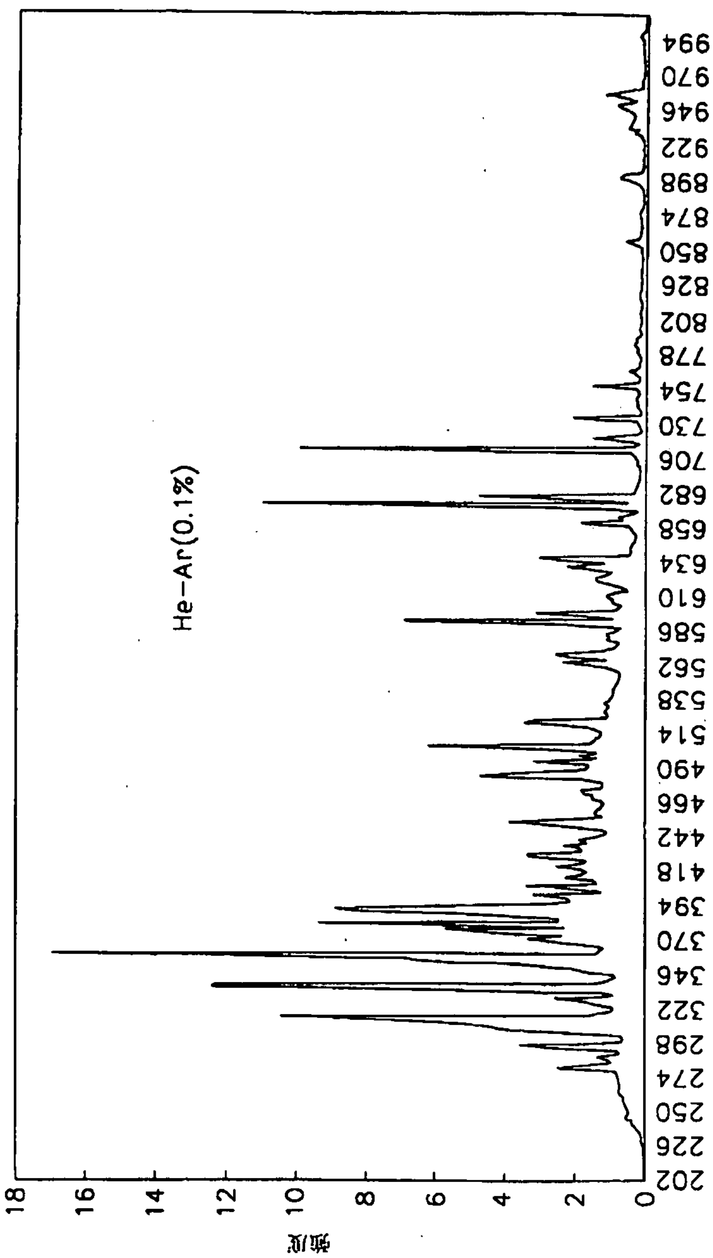
【図２】


純粋He
強度
波長 (nm)
0
2
4
6
8
10
12
14
16
18
20
202
224
246
268
290
312
334
356
378
400
422
444
466
488
510
532
554
576
598
620
642
664
686
708
730
752
774
796
818
840
862
884
906
928
950
972
994

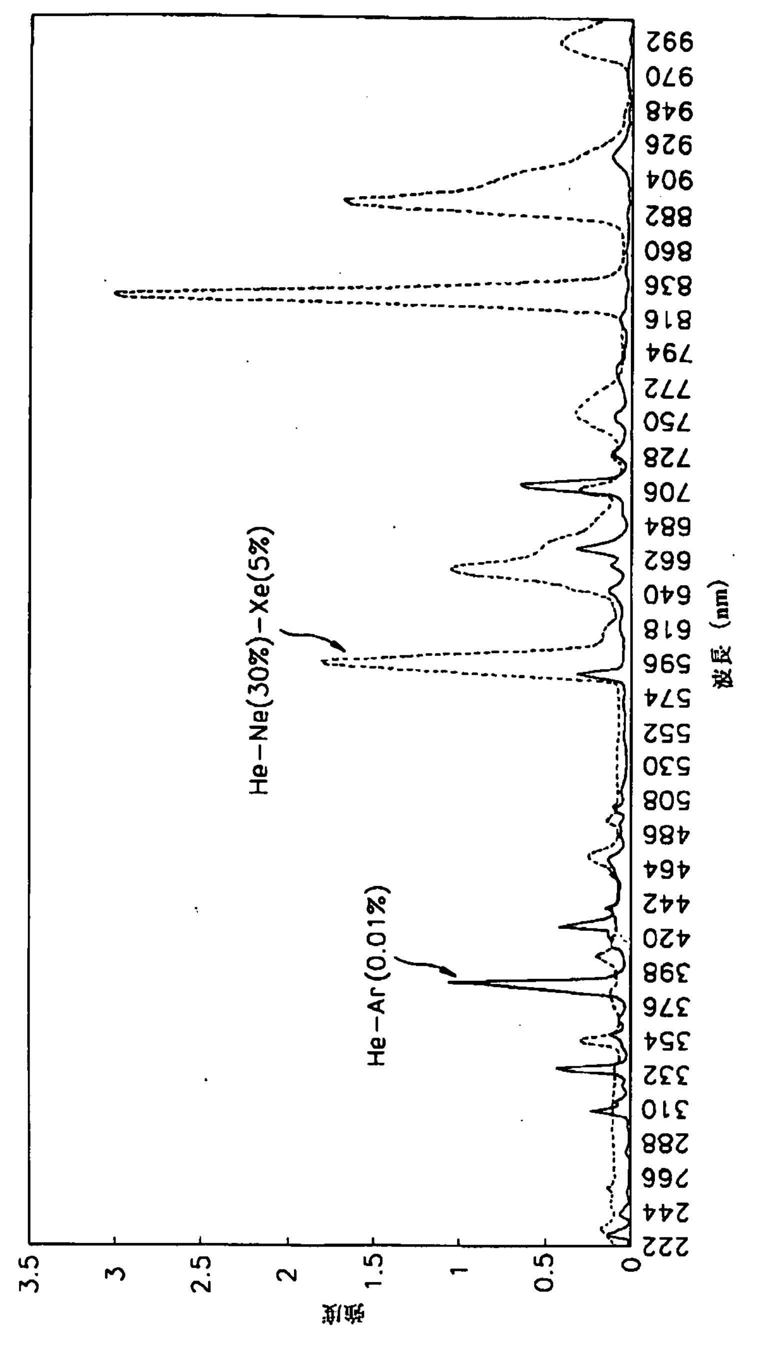
【図３】



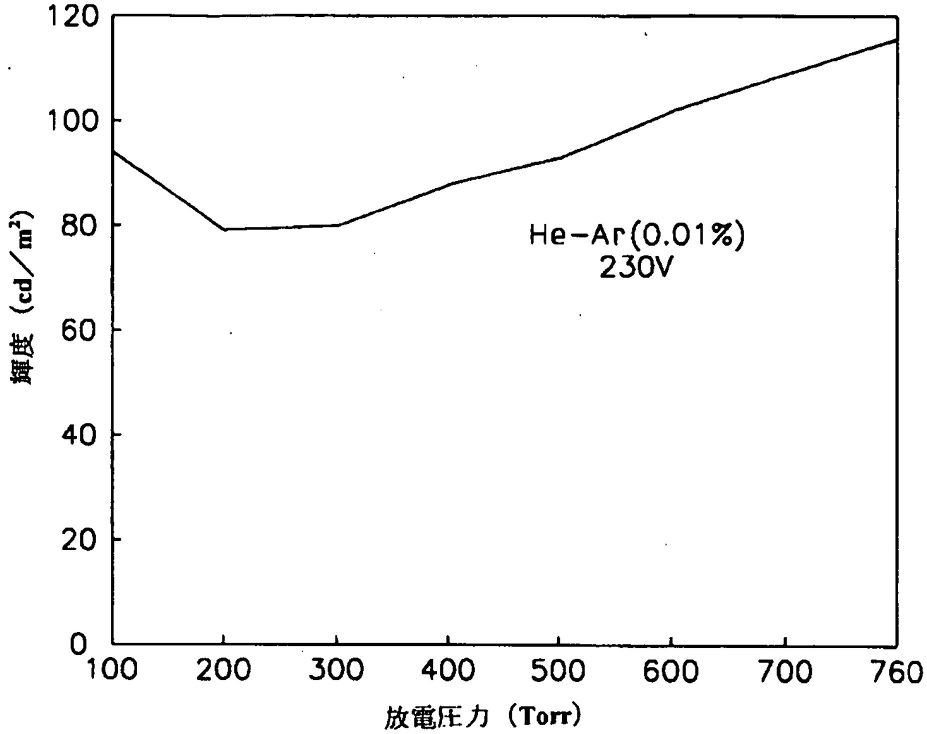
【図４】



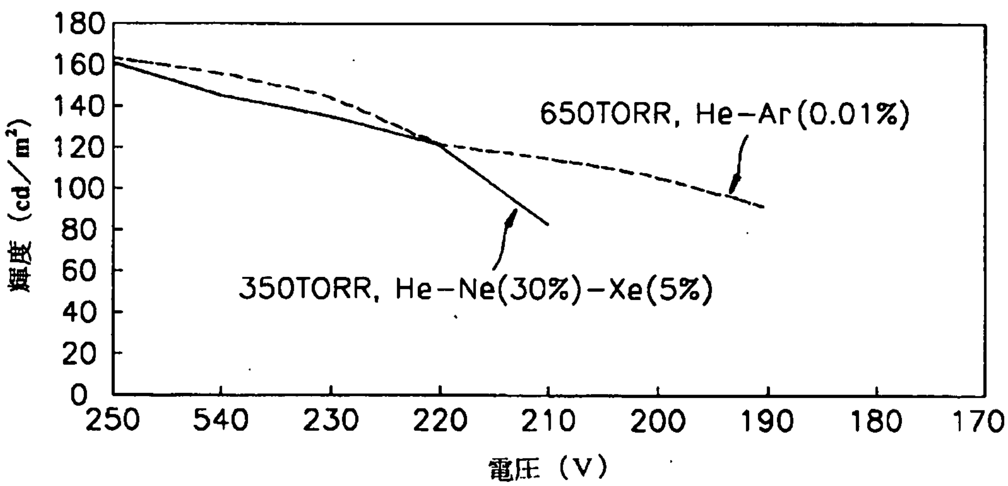
【図5】


He−Ne(30%)−Xe(5%)
He−Ar(0.01%)
波長 (nm)
強度
222 244 266 288 310 332 354 376 398 420 442 464 486 508 530 552 574 596 618 640 662 684 706 728 750 772 794 816 836 860 882 904 926 948 970 992
0 0.5 1 1.5 2 2.5 3 3.5

【図6】


120
100
80
60
40
20
0
輝度（cd／m²）
He−Ar(0.01%)
230V
100
200
300
400
500
600
700
760
放電圧力（Torr）

【図7】


180
160
140
120
100
80
60
40
20
0
輝度（cd／m²）
650TORR, He−Ar(0.01%)
350TORR, He−Ne(30%)−Xe(5%)
250
540
230
220
210
200
190
180
170
電圧（V）